Advanced, Energy Efficient Shelter Systems

Operational Capabilities Improvement Fund
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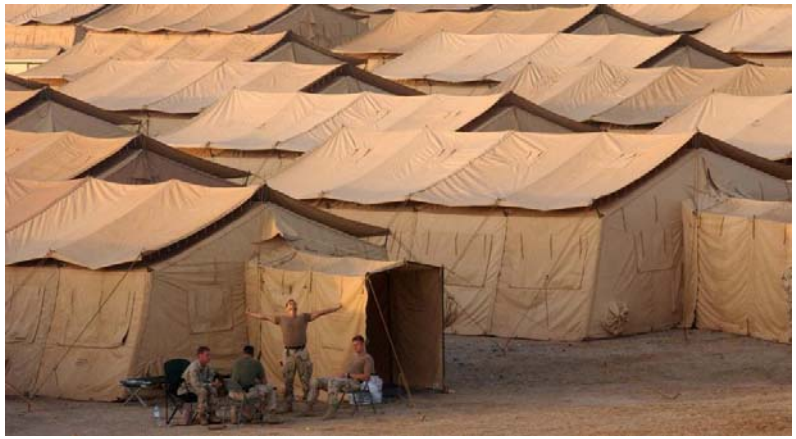
Current Challenges

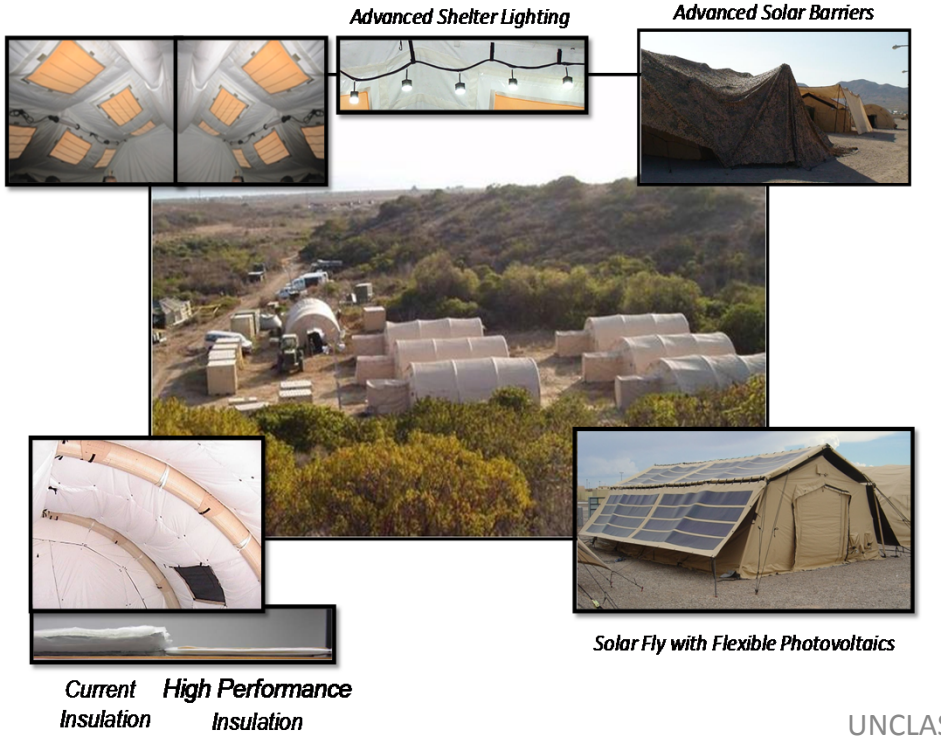
- Contingency Bases serve a vital mission capability.
- *Problem: Base camps consume excessive amounts of fuel, requiring resupply, which increases security convoy demand and diverts Warfighter efforts.*
    - Inefficiencies in currently fielded shelters
    - 5-ton Environmental Control Unit required for each small shelter
- There is a need to address the demand side
    - For every gallon of generator fuel used, it took seven gallons to transport it there.
    - HVAC is 75% of the electrical demand and 50% is lost be inefficient structures.



Advanced, Energy Efficient Shelter Systems for Contingency Basing & Other Applications

Operational Energy Capabilities Improvement Fund

- Joint Service, multi-organizational program to address inefficiencies with energy usage and fuel consumption of shelter systems
- Culmination of lessons learned will lead to optimized shelter systems to meet Joint Service needs



Program Provides:

• Initial Demonstrations – Operational evaluation of state-of-the-art shelter systems when used in the field

• Technology Development – Mature DOD and industry technologies to advance the state-of-the-art to reduce logistics/cost impact and further reduce fuel consumption

• Follow On Demonstrations – Leverage lessons learned in the Initial Demonstrations and Technology Development into optimized shelter systems and validate in the AOR.

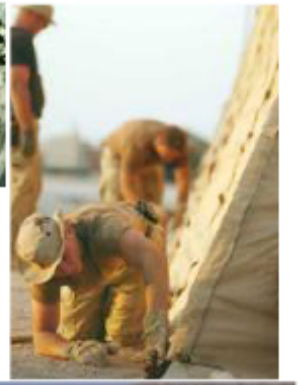
Warfighter Payoff:

• Energy efficient shelter systems optimized to reduce fuel consumption on the battlefield and manpower requirements for the Warfighter

• 50% reduction in shelter system power consumption

• 36M gal/year fuel savings

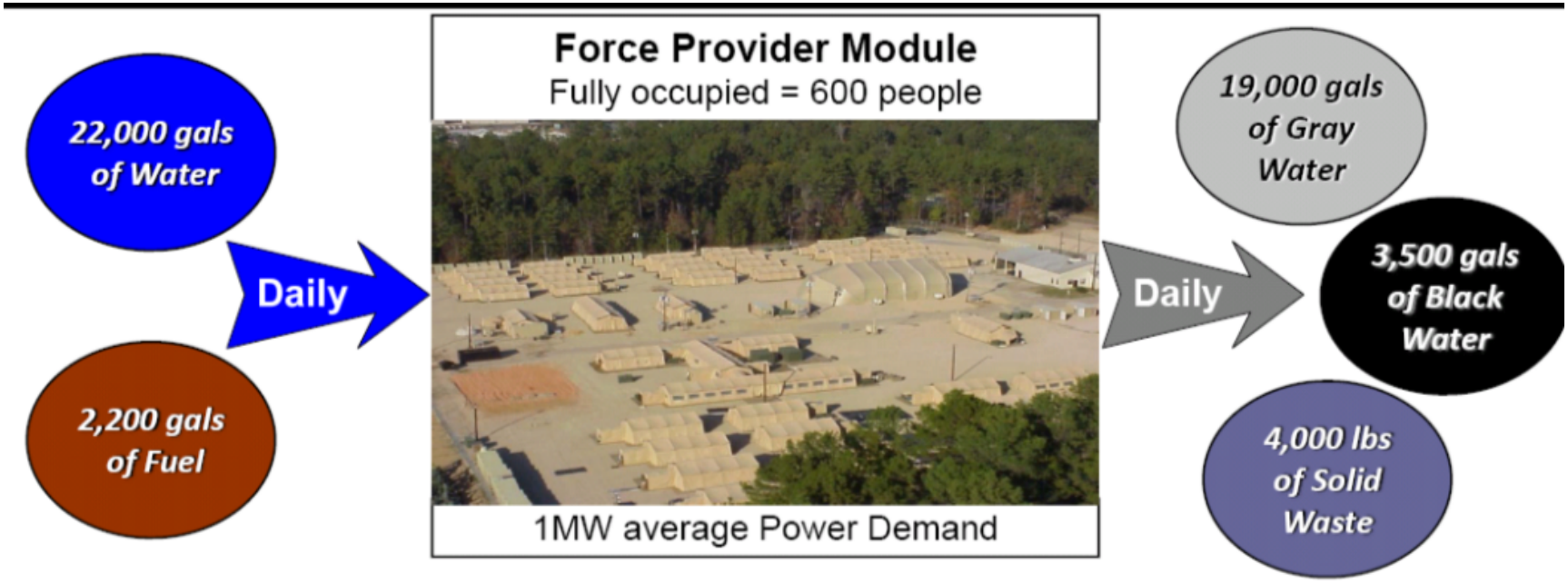
Problem: Base Energy Self-Sufficiency



- Today's deployable energy systems rely on fossil fuels for sustained operation
  - 5,280 gallons of fuel per 1,100 man squadron each day
  - Fuel supply chain disruption would impact base in less than 1 week
- Deployed base energy systems are bulky and inefficient
- Energy systems are incapable of integrating with renewable energy sources
- Energy produced on site can reduce number of fuel convoys

New expeditionary energy system must integrate with renewable power generation sources (increase supply) within a *lightweight*, *compact*, and *highly efficient* deployment package (reduce demand)

Problem: Base Energy Self-Sufficiency



~6 Truck Hauls Daily with Force Protection

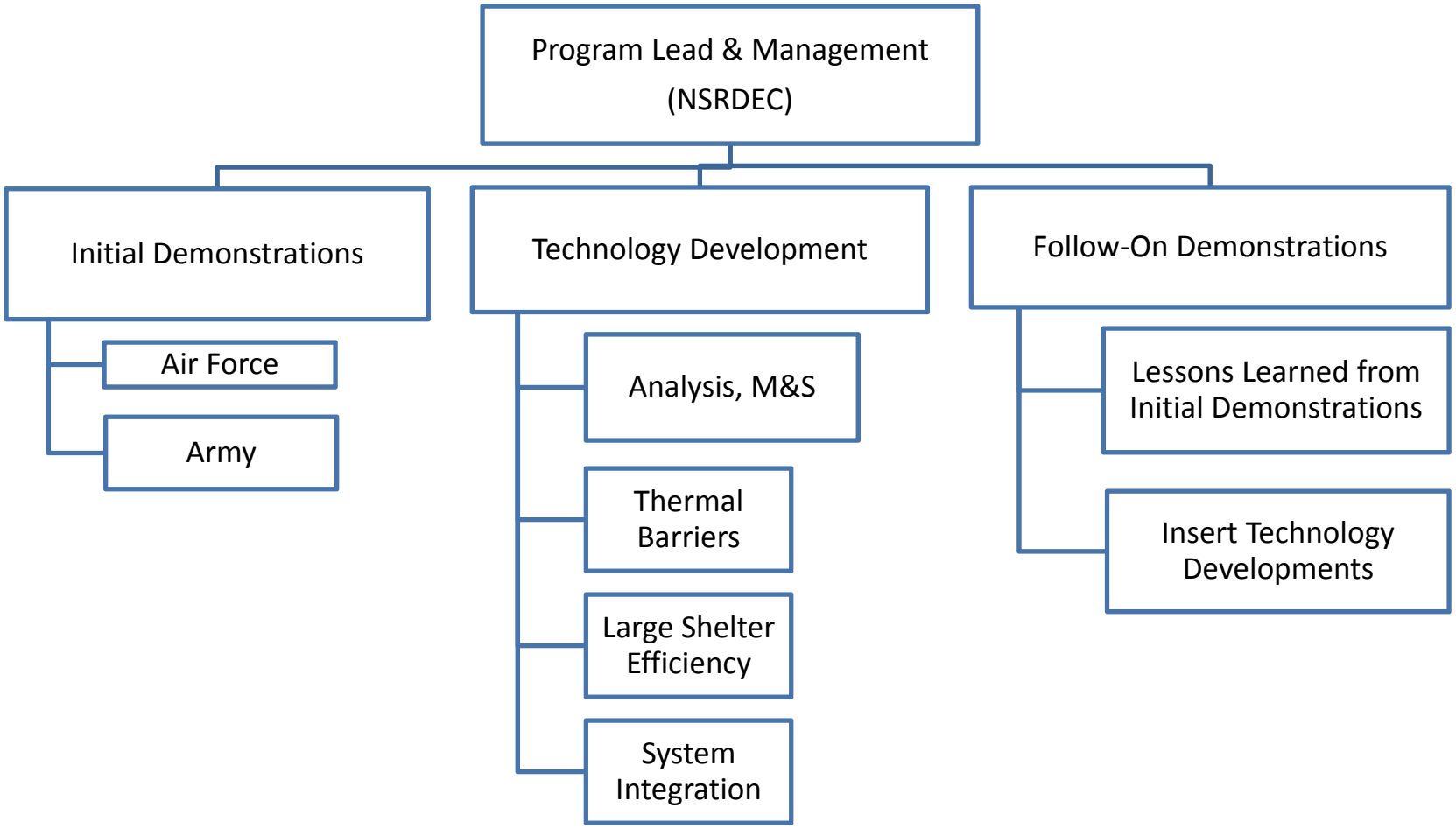
Fuel, Water, Waste Logistics Support Costs in Theatre is $40-$80M per year per FP module

Logistics Footprint Reduction Technology

Reduces Threats to Support Personnel

Return on Investment Opportunity

Program Organization



- *Integrated Project Team approach*
- *The team will leverage Joint committees and partnerships with Industry to ensure energy efficient shelter system work is an enduring, collaborative effort.*

Desired Features & Capabilities

- Solar Shades & Solar Barriers
  - Block solar load, but allow convective heat dissipation
- Thermal Insulation
  - High thermal barrier in a small, lightweight, affordable package
- Environmental Control
  - Right-sized for more efficient shelters
- High Efficiency Lighting
  - Provide sufficient light using less power than current fluorescent lights
- Shelter Efficiency Improvements
  - Ducting
  - Air Distribution
  - Occupancy Monitoring
  - Doors

Needs:
• Small packing volume
• Lightweight
• Ruggedized for military use
• Affordable
• Minimal manpower requirements

Industry Opportunities

- Multiple opportunities for Government-Industry involvement
- Seeking innovation and encourage small business participation
- Resources:
  - Federal Business Opportunities
    www.fbo.gov
  - Natick Soldier Research, Development & Engineering Center – Broad Agency Announcement
    https://www3.natick.army.mil/ssbaa.html
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Discussion, Questions & Answers

Back Up Slides

Initial Demonstrations

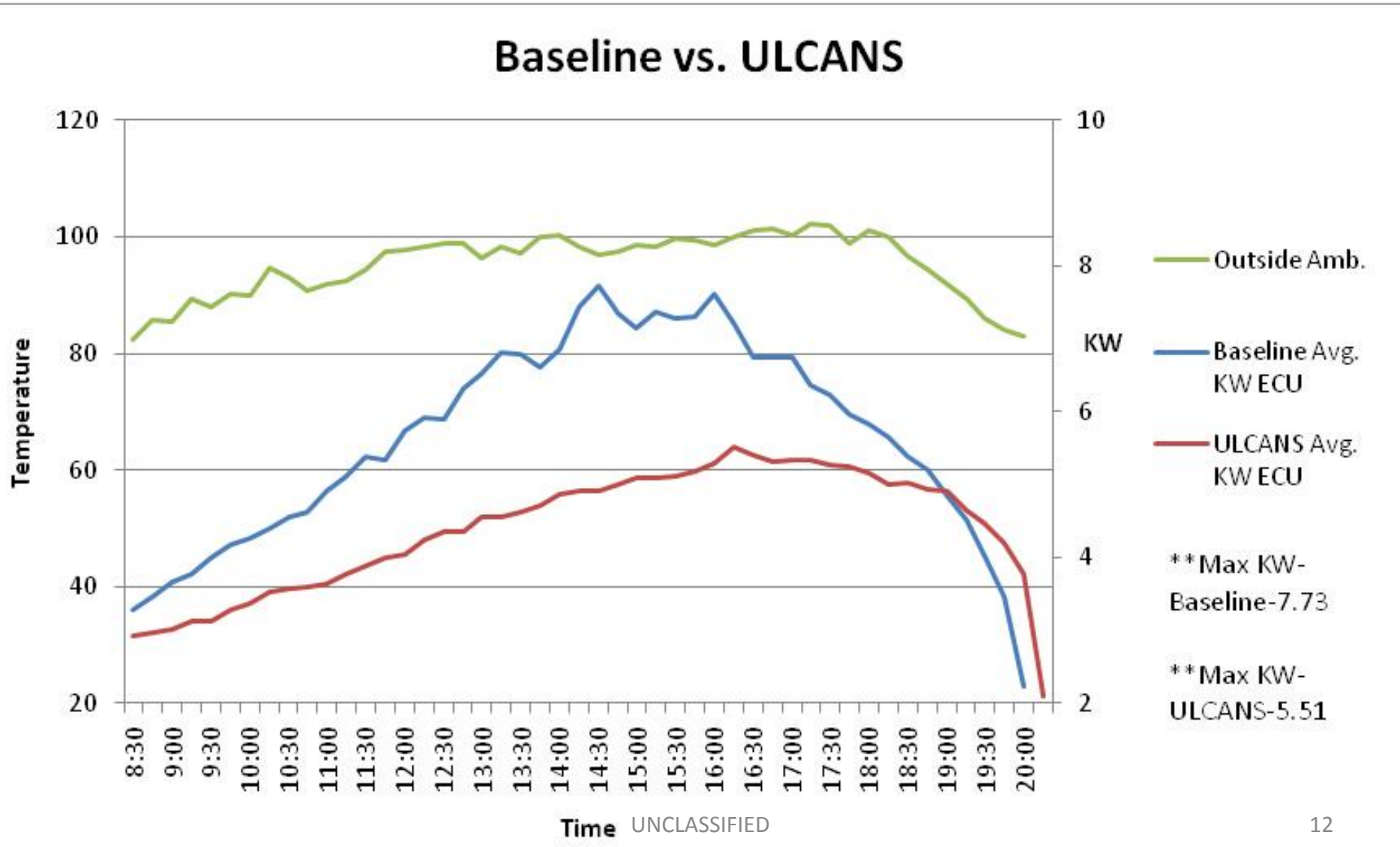
Purpose: Demonstrate the energy savings that are achievable today in a relevant environment.

Objective: This effort will leverage the technologies developed by DOD and lessons learned through recent projects to build 16 state of the art shelter systems, deploy and conduct testing in the AOR as well as CONUS Joint test sites.

Technologies:

- Solar Shades & Solar Barriers
- Thermal Insulation
- Right-Sized Environmental Control Units
- Energy Efficient Lighting
- Shelter Efficiency Improvements

Data Collection Example

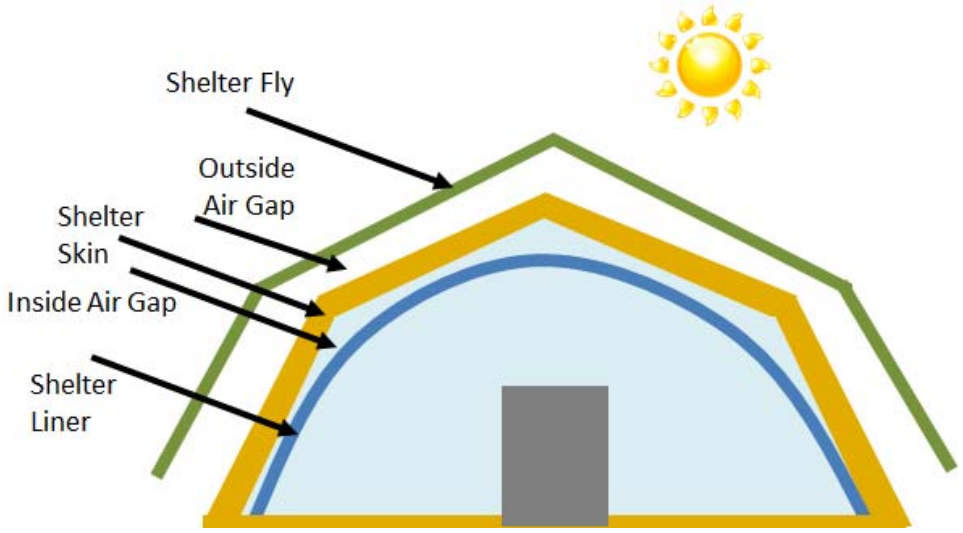


Technology Development: Modeling, Simulation & Analysis

Purpose: Optimize the design of the different shelter layers.

Objective: Establish computational models and conduct numerical experiments of the interaction between the shelter fly, shelter skin and thermal liner in order to create a more efficient design. Combine thermal and fluid computational model to address convection, conduction and radiation.

- Computational modeling of the interactions between the layers
- Thermal & fluid modeling to optimize the design of the layers
- Design for minimized air infiltration
- Intelligent occupancy modeling



Technology Development: Thermal Barriers

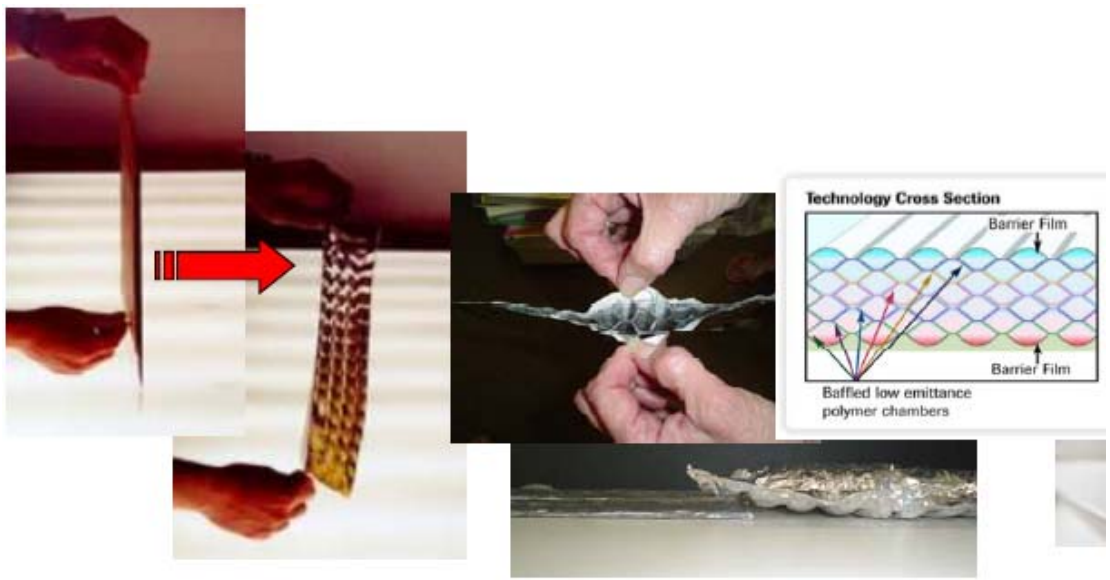
Objective: Address the enduring challenge of developing a thermal insulation for shelter systems that provides a sufficient thermal barrier, which minimizes logistics burden, while being able to withstand harsh military environments.

Technologies:

- Cellular, honeycomb-like insulation
- Advanced materials
    - Aerogel (for rigid structures)
    - Phase change material
    - Flexible ceramic coatings

Key Technical Challenges:

- Durability
- Reduced weight & size
- Deployability
- Flame resistance
- Cost



Technology Development: Large Shelter Efficiencies

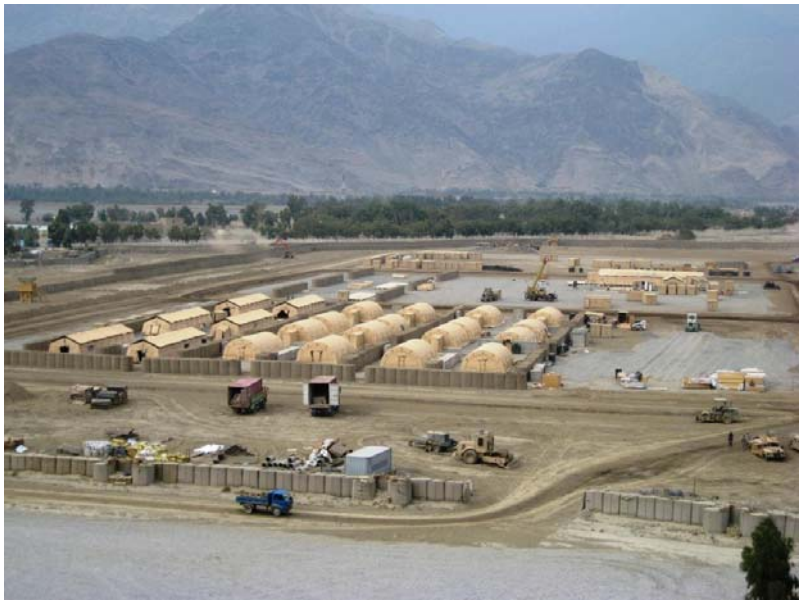
Objective: Maximize energy security for DOD assets in the field by considering the energy consumption of medium and larger shelters and the unique energy needs they impose on the deployed unit.

- Short, mid and long term efforts
- Combination of government and COTS technologies tailored for retrofit of existing military shelters
- Include adaptive technology to incorporate emerging technologies as appropriate
- Leverages the high performance insulation effort of this project

Follow-On Demonstrations

Objective: Build on and leverage the lessons learned in the Initial Demonstrations by incorporating the Technology Development accomplishments into optimized shelter systems further reducing fuel consumption.

- Most advanced and effective shelter system to include solar barrier, thermal insulation, environmental control unit and accessories
- Demonstrated and validated performance in a field environment



50% Reduction in Power Consumption = 36M gal/year Savings
Improved Capabilities
Technology Transition

Program Schedule

WBS	Task Name
1	**ADVANCED, ENERGY EFFICIENT SHELTERS**
1.1	**INITIAL DEMONSTRATIONS**
1.1.1	Identify Location(s)
1.1.2	Contracting
1.1.3	Procure Systems
1.1.4	Demonstration & Testing
1.1.5	Requirements & Reporting
1.2	**TECHNOLOGY DEVELOPMENT**
1.2.1	**Analysis and M&S**
1.2.1.1	Operational Performance Data Analysis
1.2.1.2	**Technology Development**
1.2.1.2.1	Shelter Performance Modeling
1.2.1.2.2	Improved Materials
1.2.1.2.3	Minimize Air Infiltration
1.2.1.2.4	Intelligence Occupancy Modeling
1.2.1.2.5	Integration
1.2.1.2.6	Test Plans & Assessment
1.2.1.2.7	Data Analysis
1.2.1.2.8	Economic Benefit Analysis
1.2.2	**Advanced, High Performance Insulation**
1.2.2.1	Assessment & Modeling
1.2.2.2	Component Validation
1.2.2.3	System Design
1.2.2.4	System Validation in Relevant Environment
1.2.2.5	Final Optimization & Manufacturing Capabilities
1.2.3	**Large Shelter Efficiencies**
1.2.3.1	Needs Study and Report
1.2.3.2	Near Term Demonstration
1.2.3.3	Innovative Design
1.2.3.4	Testing
1.2.3.5	Implementation
1.3	FOLLOW-ON DEMONSTRATIONS